**Cross-over in the dynamics of polymer confined between two liquids of different viscosity**

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SUPPORTING INFORMATION

In order to test the viscosity correlations of Reference 30 in the main text, we calculated the viscosity of a Lennard-Jones fluid of =0.47nm and =2.47 kJ/mol (bead type F1 in Table 1 of the main text) using the non-equilibrium method implemented in GROMACS 1.

We built a cubic box consisting of 6025 particles with a reduced density ρ\*=0.745. We run non-equilibrium simulations in *NVT* ensemble with T\*=1.1 at different shear stresses to find the value of the bulk viscosity. We found that =1.56×10−4 Pa s, against a predicted value of 1.53×10−4 Pa s obtained using the viscosity correlation equation of Galliero at al. 2. The zero-shear viscosity has been extrapolated by plotting the viscosity values as a function of the cos-acceleration, representing the amplitude of the acceleration profile (Figure 1). In the Figure below we show the curve representing the viscosity-cos-acceleration relationship, where the circles are the simulation results and the line is the best fitting of the simulation points.



**Figure 1**. Viscosity plot.

**References**

1. Abraham, M. et al. User Manual. SpringerReference 312 (2014)

2. Galliéro, G., Boned, C. & Baylaucq, A. Molecular Dynamics Study of the Lennard−Jones Fluid Viscosity:  Application to Real Fluids. *Industrial & Engineering Chemistry Research* **44**, 6963-6972, (2005).